**Soil as a Buffer for Acid Rain**

Ms. Bibiloni, 5th grade Science

**Description**: This activity builds upon prior lessons about the scientific method, pond ecosystems, acid rain, and the pH scale. Students have already constructed a pond model (soil, water, duckweed, assorted grasses) that they have been observing over a two week time period and recording changes. This activity will be completed over two periods (two weeks). One week to observe, question, hypothesize and plan, and one week to carry out the procedure, record results, draw conclusions, and revise hypotheses.

**NY State Science Standards:**

2.2r Substances enter the atmosphere naturally and from human activity. Some of these substances include dust from volcanic eruptions and greenhouse gases such as carbon dioxide, methane, and water vapor. These substances can affect weather, climate, and living things.

PS.G.8 Students identify cause-and-effect relationships

PS.G.9 Students use indicators and interpret results

**Professional Standard:**

Danielson Competency 3c: Engaging students in learning

**Objectives**: Students will demonstrate an understanding of the scientific method.

Students will understand the cause/effect relationship between human activity and

environmental pollution.

Students will be engaged in the activity by creating, testing, and revising their

procedures.

**SLO**: Students will design a way to test the buffering ability of soil.

**Vocabulary**: *buffer, pH, acid rain, acid, base, neutral, pH scale*

**Materials:** coffee filters, funnels, plastic beakers, soil from pond model, “acid rain” (vinegar/water solution), pH drops, plastic vials, plastic spoons, laminated pH scales

**Focus Question**: Would the soil from your pond model be a good buffer for acid rain?

**Part 1**

**Observaition** (7 min): Students will watch a video <http://www.pbslearningmedia.org/resource/watsol.sci.ess.water.amdren/acid-mine-drainage-remediation/>

about acid mine drainage remediation and write down any questions/observations they have.

**Discussion** (5-10 min): In groups of 6, students will answer the following questions:

\*scaffolding/differentiation: Students may use the glossary of their textbook, previous notes, and the internet to research answers IF they need to.

1. What is a buffer and what can it do to acid rain? (A substance that can neutralize acidity when water pases through it by raising the pH.)
2. What was the buffer used in the video? (limestone)
3. What would happen to your pond model if acid rain fell on it? (The pH level would rise. The duckweed might die.)

**Hypothesis** (5-10 min): Create a hypothesis that provides a possible answer to the focus question.

Focus Question: Would the soil in our pond make a good buffer for acid rain?

\*scaffolding/differentiation: Post prompt on the board or hand out to groups who need it on sentence strips. “ I think\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_because\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.”

**Plan** (15-20 min): Show students the materials that are available. Have them write the steps of a procedure that would prove or disprove their hypotheses.

\*scaffolding/differentiation: Students can get materials as necessary to help them visualize how their plan will work.

**Part 2**

**Procedure** (15-20 min): Groups carry out their procedures and record all observations in their notebooks.

\*scaffolding/differentiation: Teacher can assign jobs if necessary. Otherwise, one group manager is assigned who gives out jobs based on the steps in the procedure.

**Groups present and compare results** (15-20 min): (Most groups will find that the soil does raise the pH when water is passed through it.) As each group shows the class what happened during their procedure, other groups are taking notes on how their results compare.

**Conclusions, Reflections, Revisions** (10-15 min): Students write about how effective or ineffective their procedure was at proving/disproving their hypotheses. They then go back and revise their procedures and hypotheses accordingly. At least one person per group shares their reflections and revisions with the class.

**Extension** (1 period the following week):

Review- Ask students how soil can help with acid rain. Then ask what will happen to the pond water that acid rain has fallen directly on. Do they think there is a way to raise the pH and clean the water?

Introduce the “Design a Water Filter” activity and allow students to plan, then experiment with funnels, coffee filters, panty hose, cotton, sand, activated charcoal, gravel, lime, and “acid rain” (pre-made vinegar and water). They can present and compare their results at the end.

Assignment: Ask students to write an “official” science paper comparing the two activities and explaining the importance of researching buffers and filters for acid rain.

Rubric:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Definitely | Kind of | Nope |
| Did I explain my hypothesis? |  |  |  |
| Is my procedure clear and easy to follow? |  |  |  |
| Did I record all of my observations? |  |  |  |
| Does my conclusion include an analysis or revision of my hypothesis? |  |  |  |
| Did I contribute to my group’s work? |  |  |  |